

(12) UK Patent Application

GB (11) 2 219 313 (13) A

(43) Date of A publication 06.12.1989

(21) Application No 8911897.0

(22) Date of filing 24.05.1989

(30) Priority data

(31) 3819151
3839045

(32) 04.06.1988
18.11.1988

(33) DE

(51) INT CL*
D06F 67/04

(52) UK CL (Edition J)
D1A A11B

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) D1A
INT CL* D06F

(71) Applicant

Martin Kannegiesser
Drosselweg 10, D-4902 Bad Salzuflen,
Federal Republic of Germany

(72) Inventors

Friedhelm Mehrhoff
Dietrich Lux

(74) Agent and/or Address for Service

R R Prentice & Co
34 Tavistock Street, London, WC2E 7PB,
United Kingdom

(54) Feeding and stretching laundered sheets

(57) Laundered sheets 10 each gripped by only a first corner 16 are fed along conveyor 27. Before the first corner is released a second corner 17 is gripped, directly by stretching clamp 15 or by transfer clamp (30, fig.1) or 49. The first corner is then transferred to stretching clamp 14 and the sheet stretched transversely and fed to a mangle. In the automatic apparatus shown clamp 49 moves along the sheet front edge to locate and clamp corner 17 before transferring it to ancillary conveyor 50. Corners 16,17 are then transferred first to parallel discharge conveyors 28,53 then pivotable transport members 35,54 and finally to stretching clamps 14,15.

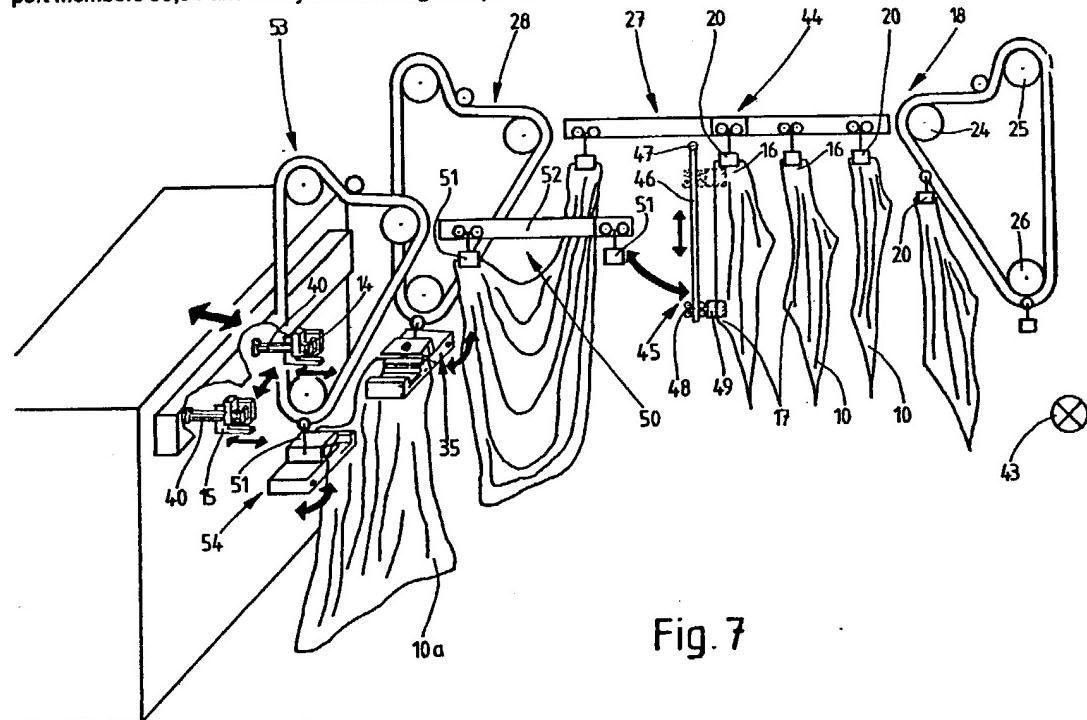
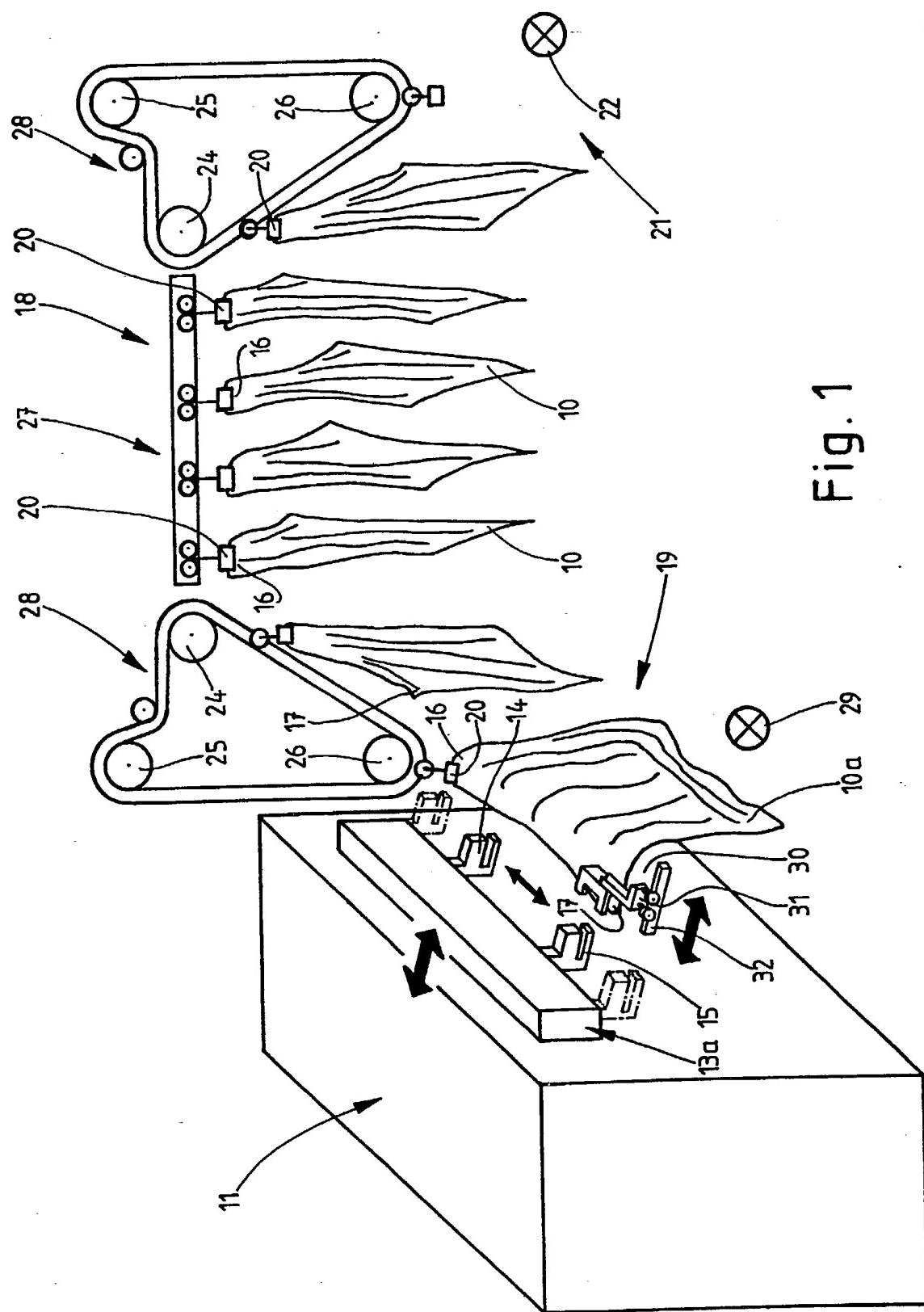


Fig. 7

GB 2 219 313 A



۷

2219313

2/7

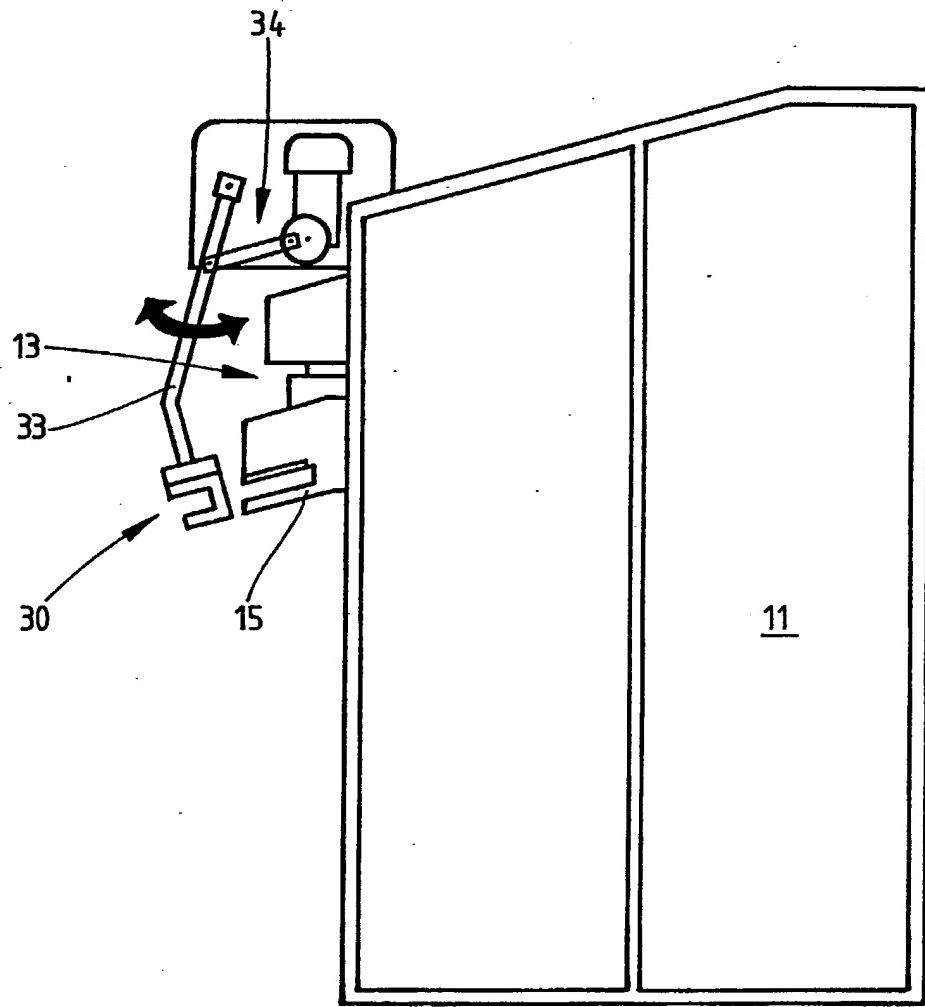


Fig. 2

3/7

2219313

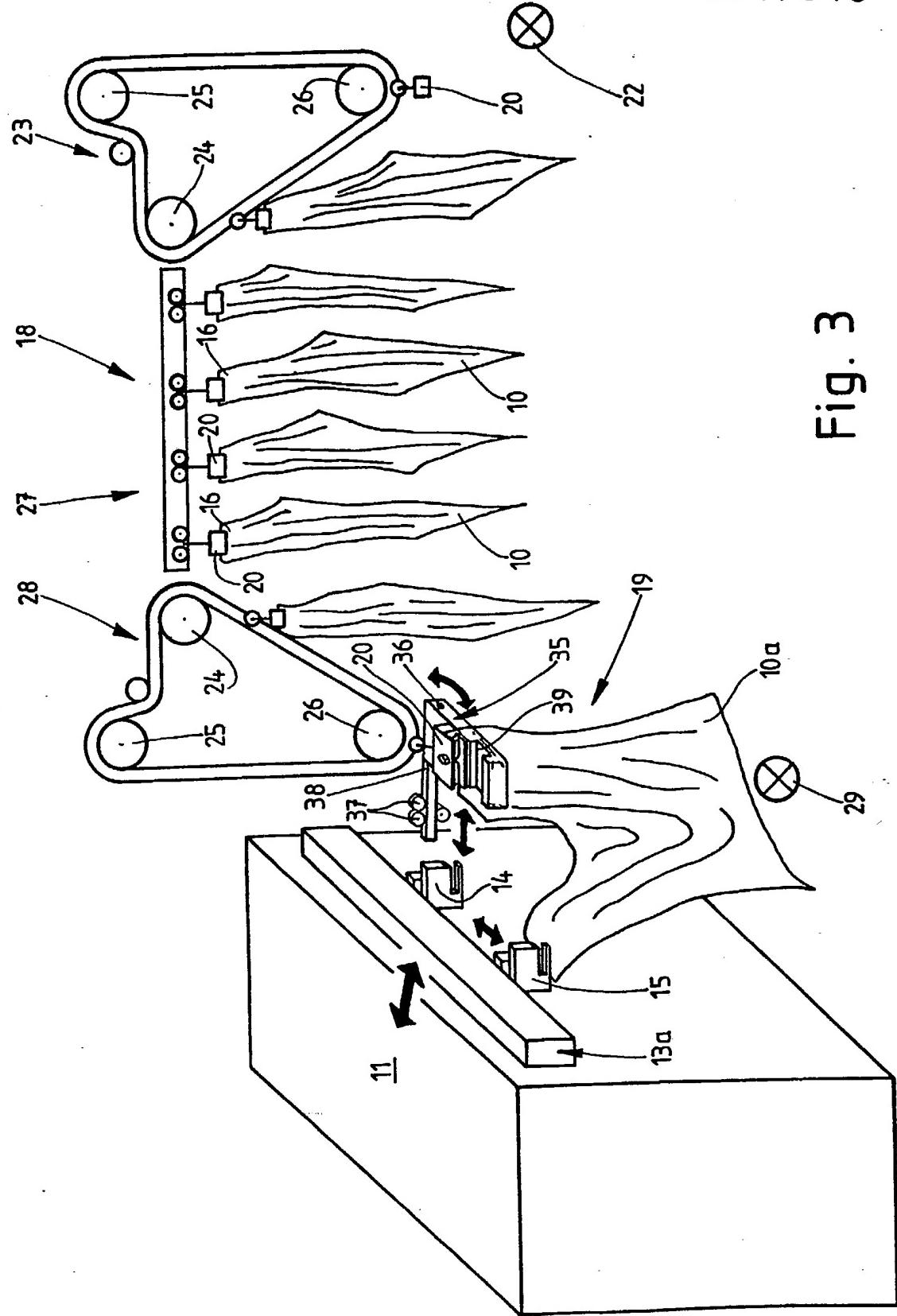


Fig. 3

4/7

2219313

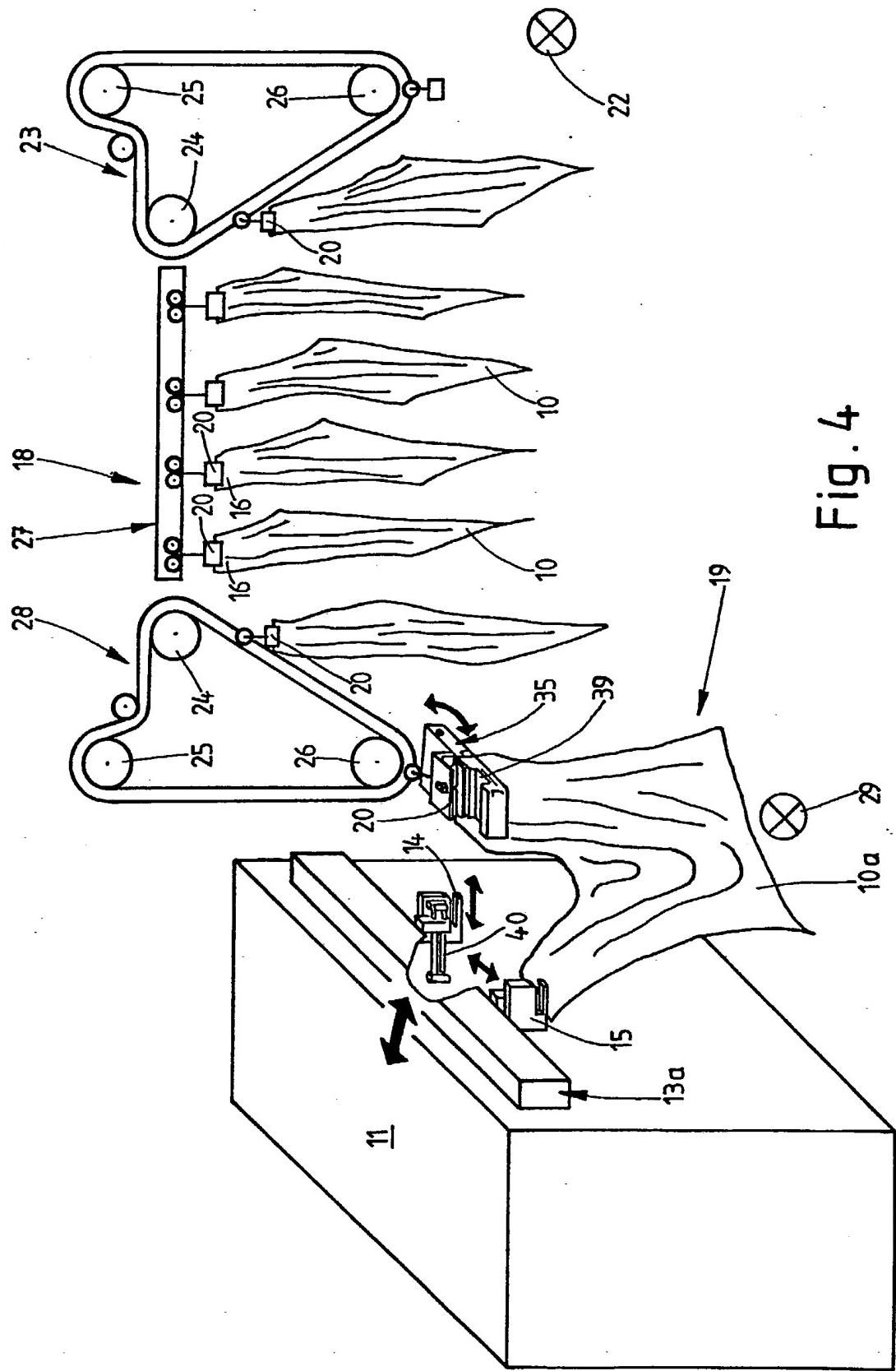
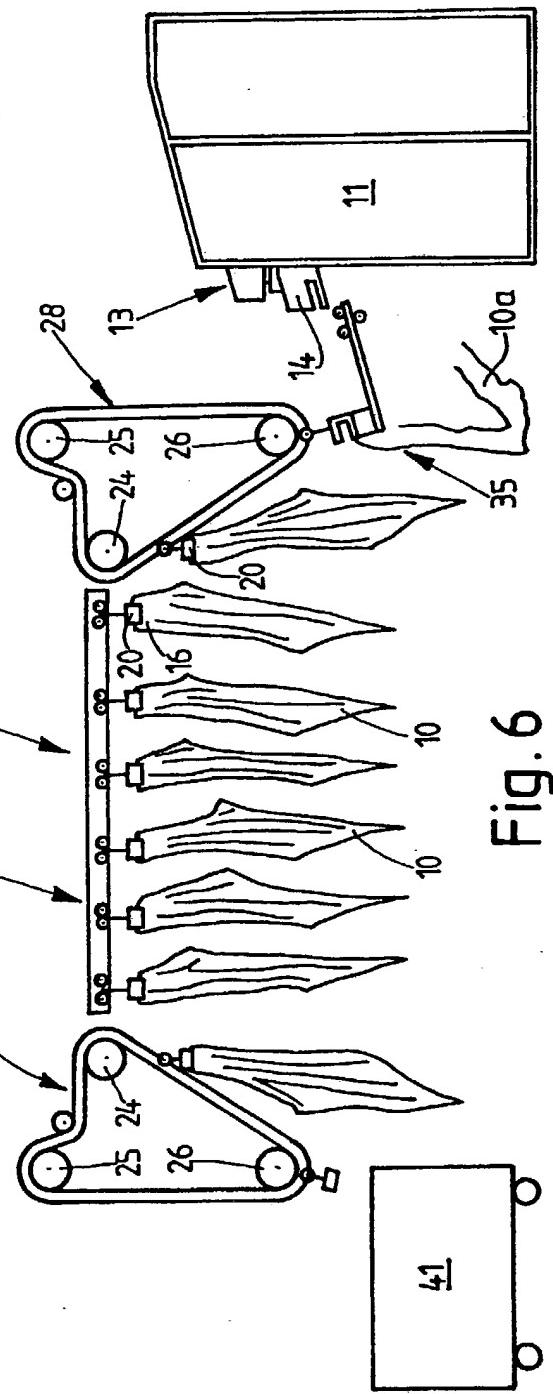
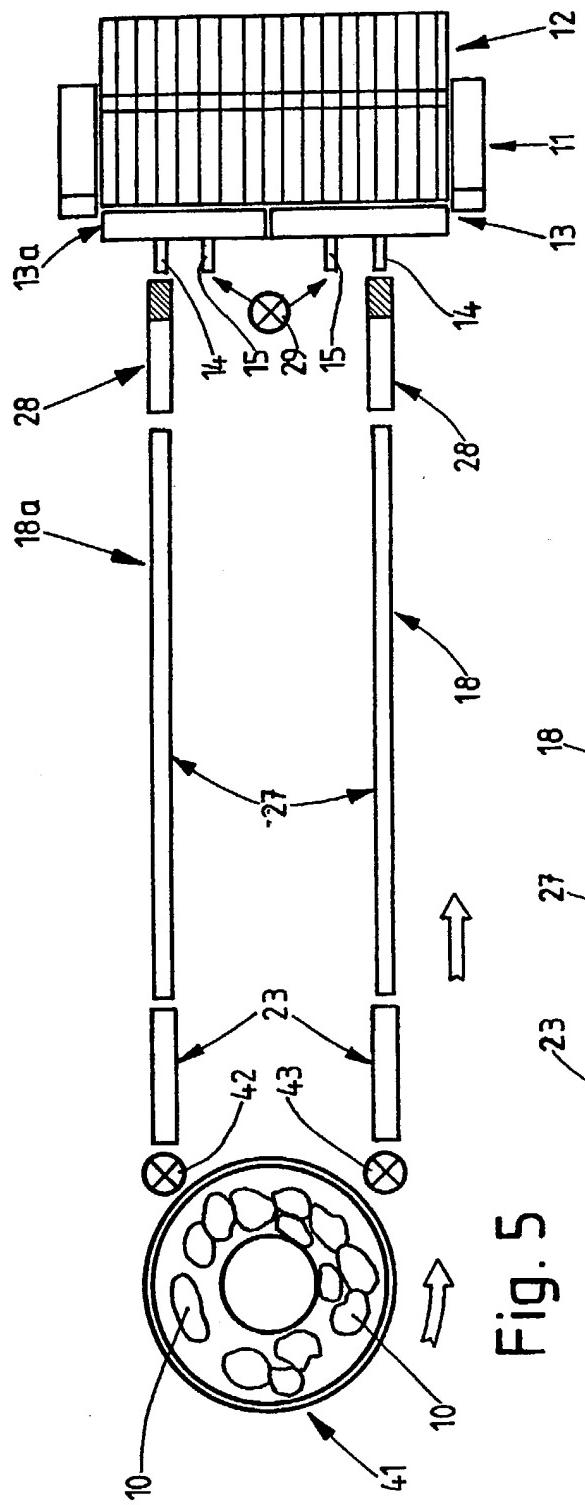


Fig. 4

5/7

2219313



2219313

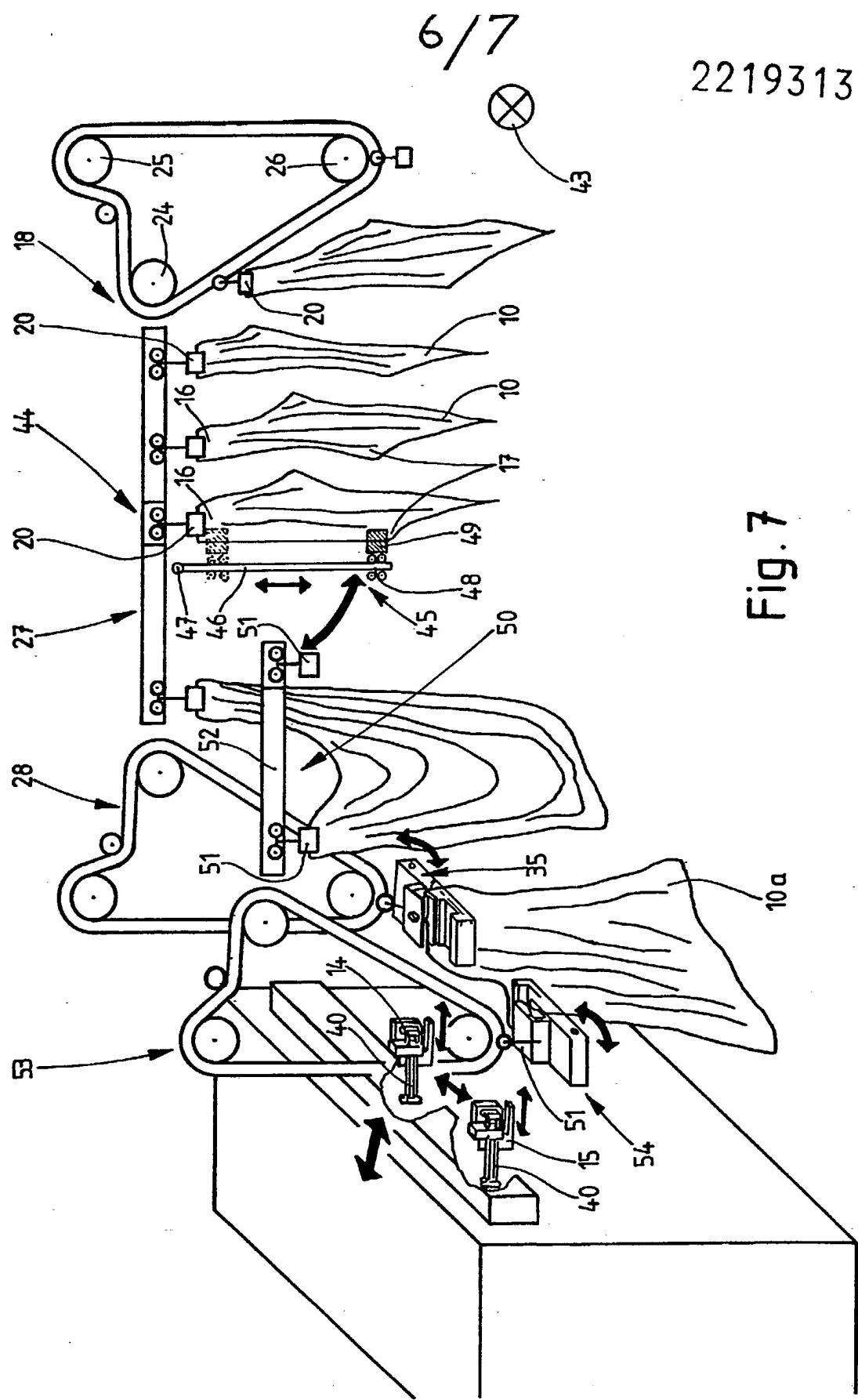
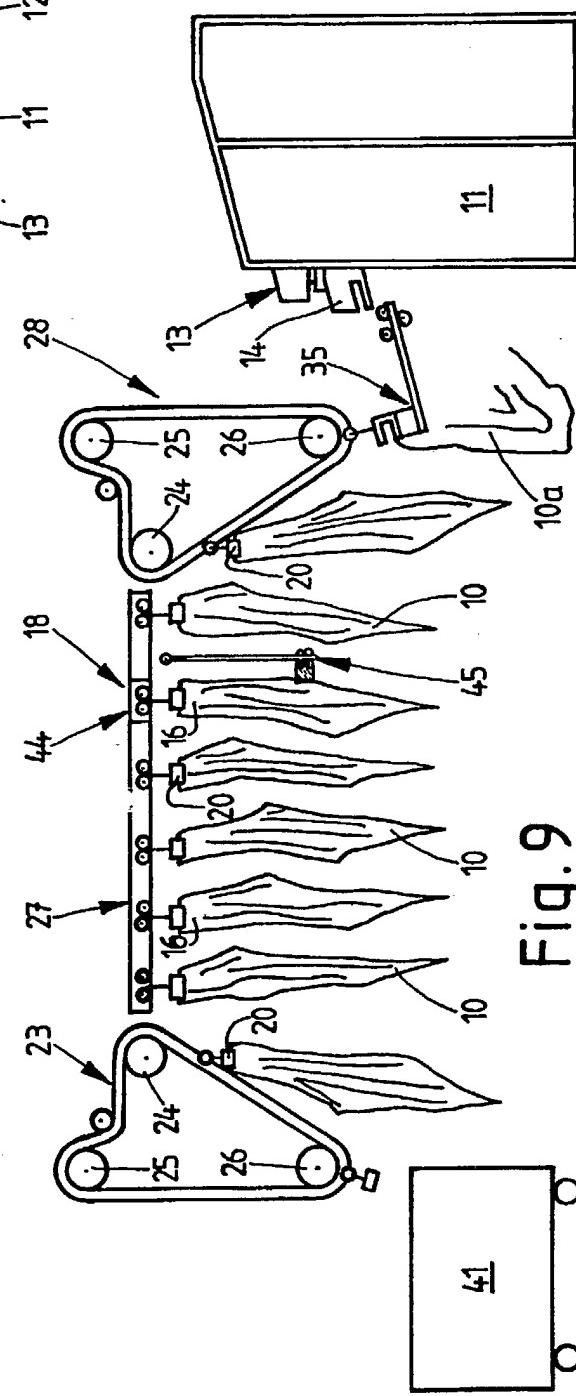
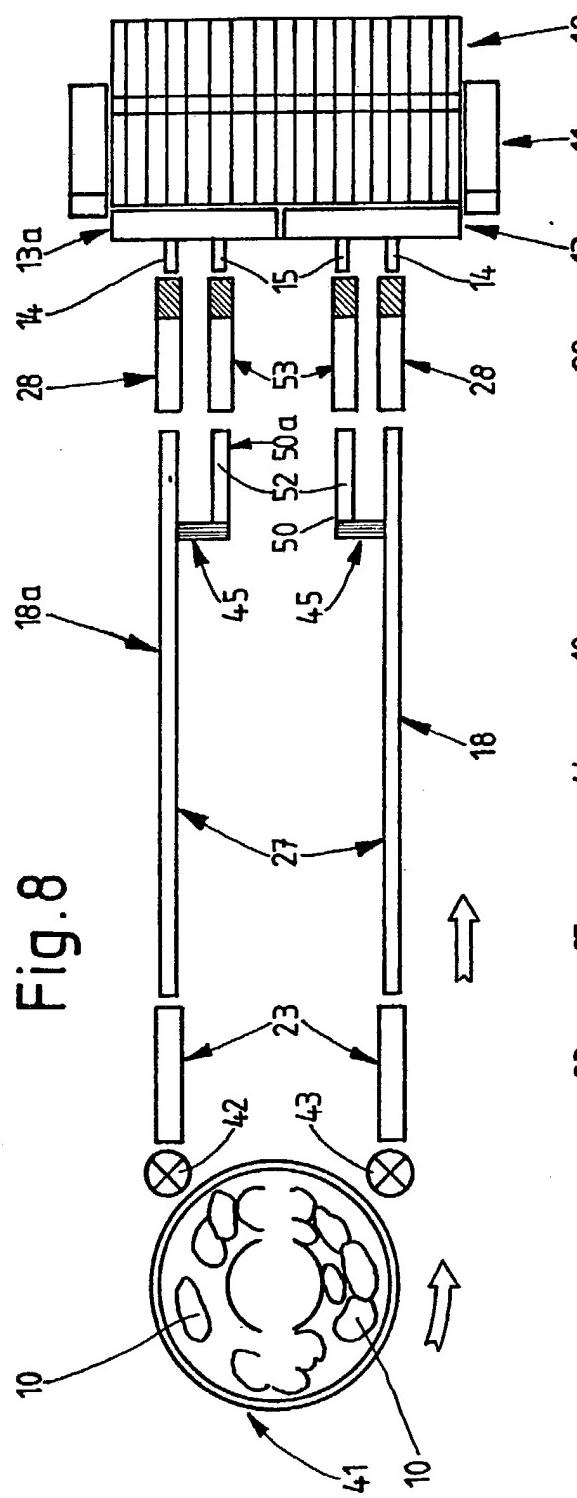


Fig. 7

7/7

2219313



Title: Method and apparatus for feeding laundry
articles to a mangle

The invention relates to a method for feeding laundry articles to a mangle or the like, in which the 5 laundry articles are moved in front of a feed conveyor leading to the mangle by a spreading device having at least two clamps (spreading clamps) for grasping two corners of the laundry article, the laundry articles being fed to a transfer station assigned to a spreading 10 device by an article conveyor having a plurality of transport clamps for grasping one corner of the laundry article. The invention relates, furthermore, to an apparatus for feeding laundry articles to a mangle or the like.

15 An apparatus for feeding laundry articles to a mangle is known from German Patent Specification 3,119,600. One of two corners of the laundry article is introduced into a clamp of the spreading device. The clamps are then moved apart from one another in order to 20 tension the laundry article and are centred in front of a feed conveyor leading to the mangle. The spread laundry article is then transferred to the feed conveyor.

It is also already known, in practice, to feed the laundry articles to a spreading device by means of an 25 endless conveyor. For this, the laundry articles are each held at one corner by means of conveying clamps. In

the region of the transfer station assigned to the spreading device, the laundry articles are (manually) removed from the transport clamps and transferred to the spreading device.

5 In an apparatus of this type and in the method described, the handling of the laundry articles still involves a relatively high outlay and is therefore time-consuming.

10 The object on which the invention is based is to increase the efficiency of the feeding of laundry articles to a mangle or the like or reduce the amount of manual activity employed.

15 To achieve this object, the method according to the invention is characterized in that first a free corner of the laundry article is introduced into a clamp (spreading clamp) of the spreading device and then the corner held by the transport clamp of the article conveyor is released and introduced into the other clamp of the spreading device.

20 In the method according to the invention, the article conveyor or its transport clamp performs the function of a holder of the laundry article during the introduction of a corner of the latter into one of the two clamps of the spreading device. The corner of the laundry article which is grasped first (manually) and which hangs down can be introduced into the respective spreading clamp of the spreading device even during transport by the article conveyor. When the transport clamp holding another corner of the laundry article has reached the end of the conveying zone, there is merely a transfer of the corner held by the article conveyor to the second spreading clamp of the spreading device. An attendant can thus achieve a higher output.

35 However, according to another proposal of the invention, the transfer of the laundry articles from the article conveyor to the spreading device can also take place automatically by mechanical means.

In a first embodiment of the method according to the invention and of an apparatus according to the

invention, for the partial mechanisation of the transfer operation there is a conveying member for transferring the free first-grasped corner of the delivered laundry article to a spreading clamp, especially a transversely movable or pivotable transfer clamp. The free corner of the laundry article is introduced into this. Transfer to the associated spreading clamp of the spreading device then takes place automatically by means of a transfer clamp.

Alternatively or additionally, the corner of the laundry article grasped by the transport clamp of the article conveyor can also be transferred to the associated spreading clamp mechanically. For this purpose, in the region of the transfer station there is a transfer member which feeds the transport clamp, together with the laundry article, to the spreading clamp, in such a way that the latter receives the corner of the laundry article from the transport clamp. Alternatively, the spreading clamp of the spreading device can be arranged so as to be movable transversely relative to the spreading plane, in such a way that it is movable relative to the transport clamp in order to receive the corner of the laundry article.

The transfer according to the invention of the laundry articles from the article conveyor to the spreading device can be used especially advantageously in an installation with a dual mode of operation. With appropriate dimensions of the mangle and of the feed conveyor and with the use of two independently working spreading devices which are arranged next to one another and to each of which is assigned a separate article conveyor for feeding the laundry articles, an attendant can tend both article conveyors and both spreading devices of the installation in the region of the feed station. This is possible because only one corner of each laundry article has to be handled by the attendant.

According to a further version of the invention, the transfer of the laundry articles from the article conveyor to the spreading device is completely mechanised

and therefore takes place automatically. For this purpose, in the region of the article conveyor, the laundry articles are grasped immediately underneath the conveying clamp by an edge-catching device or its catching clamp along an edge of the laundry article which is vertical when the latter is spread out. The catching clamp moves down along this edge of the laundry article, until the next free corner of the laundry article is detected. This corner is then grasped by the catching clamp and, as a result of the pivoting of the edge-catching device, transferred to a separate article conveyor. Each laundry article is now grasped at two corners and is thus fed to the spreading clamps of the spreading device.

Exemplary embodiments of the apparatus according to the invention are explained in detail below by means of the description, with the method according to the invention being illustrated. In the drawing:

- Figure 1 shows a simplified diagrammatic representation of an apparatus for feeding laundry articles to a mangle,
- Figure 2 shows a side view of a detail of the apparatus on an enlarged scale,
- Figure 3 shows a further exemplary embodiment of the apparatus in a representation corresponding to that of Figure 1,
- Figure 4 shows a third exemplary embodiment of the apparatus according to the invention in a representation corresponding to that of Figure 1 or of Figure 3,
- Figure 5 shows a diagrammatic plan view of a dual apparatus,
- Figure 6 shows a side view of the apparatus according to Figure 5,
- Figure 7 shows an embodiment of an apparatus with a completely automatic entry of the laundry articles into an entry machine,
- Figure 8 shows a diagrammatic plan view of a dual installation, with the laundry articles

transferred in accordance with Figure 7,
Figure 9 shows a side view of the installation according
to Figure 8.

The feed of laundry articles 10 to a mangle (not
5 shown) or to another laundry treatment machine takes
place largely mechanically. For this purpose, the mangle
is preceded by an entry machine 11. This can be designed,
for example, as illustrated and described in German
Patent Specification 3,119,600. The spread-out laundry
10 articles 10 are delivered to a feed conveyor 12 which
conveys them into the mangle.

Arranged in front of the feed conveyor 12 formed
from belts is a spreading device 13, by means of which
the laundry articles are spread transversely in one plane
15 in front of the feed conveyor 12 and laid onto this. For
this purpose, the spreading device 13 is equipped with
spreading clamps 14 and 15 movable relative to one
another. These are driven (see, for example, German
Patent Specification 3,119,600) in such a way that they
20 can be moved towards and away from one another, the
latter for the purpose of spreading a laundry article 10.
To this effect, corners 16 and 17 of the laundry article
10 are introduced into the respective spreading clamps
25 14, 15, especially when the spreading clamps 14, 15 have
been moved laterally to a short distance from one another.

In the illustrated exemplary embodiments of the
apparatus, the feed of the laundry articles 10 to the
spreading device 13 is substantially or completely
30 mechanised and automated.

For this purpose, the laundry articles 10 are
delivered successively by an article conveyor 18 to a
feed station 19 in front of the spreading device 13. The
article conveyor 18 is designed as a revolving conveyor
35 or endless conveyor with a relatively large number of
transport clamps 20, each for receiving one corner 16 of
the laundry article 10 (the exemplary embodiments accord-
ing to Figures 1, 3, 4, 5 and 6). The article conveyor
18 is loaded by an attendant 22 (or, if appropriate, by

several attendants) in the region of a loading station 21 which under certain circumstances is distant from the entry machine 11. The laundry articles 10 are extracted from a laundry treatment machine, a dryer or a stock and
5 are introduced at one corner 16 into a transport clamp 20.

In the exemplary embodiments according to Figures 1 to 6, the article conveyor 18 is of conventional design. In the region of the loading station 21, the article conveyor 18 forms an (endless) loading conveyor 23. This is guided via three deflecting rollers 24, 25, 26. The lower deflecting roller 26 is at a reasonable working height for the attendant 22, so that the loading conveyor 23 can be loaded in this lower region. The
10 laundry articles 10 are then conveyed obliquely upwards by the loading conveyor 23 as far as a storage conveyor 27 located at a greater height. In the region of the latter, a plurality of transport clamps 20 with laundry articles 10 can be arranged closely next to one another
15 and at the same time conveyed further.
20

The storage conveyor 27 is followed in the region of the feed station 19, that is to say in front of the entry machine 11, by a discharge conveyor 28 for the transport clamps 20 with laundry articles. In the region
25 of this discharge conveyor 28, the transport clamps 20 received from the storage conveyor 27 are moved downwards to a height appropriate for removal and transfer to the entry machine 11. A discharge conveyor 28 is designed here in the same way as the loading conveyor 23, that is to say with deflecting rollers 24, 25, 26. In the region
30 of the lower deflecting rollers 26, the laundry articles 10 are removed from the transport clamps 20, by an attendant 29 in the exemplary embodiment according to Figures 1 to 6.

35 The transfer of the transport clamps 20 from the loading conveyor 23 to the storage conveyor 27 and from this to the discharge conveyor 28 takes place automatically by suitable known transfer means.

The laundry articles 10 can be transferred from

the article conveyor 18 to the entry machine 11 in various ways. In the exemplary embodiment according to Figure 1, the attendant 29 takes action by introducing into the transfer clamp 30 the corner 17 which is located under the transport clamp 20 when the laundry article is spread out. During this phase, the laundry article is still held at the corner 16 by the transport clamp 20 of the article conveyor 18 in the discharge conveyor 28. This is preferably arranged off-centre, that is to say offset to the side in relation to the entry machine 11. That corner 17 of the laundry article 10a to be introduced which is located in the transfer clamp 30 is now introduced automatically into the spreading clamp 15 remote from the article conveyor 18. The laundry article is thereby held in this region. At the same time, the opposite corner 16 is extracted from the transport clamp 20 by the attendant 29 and introduced directly into the spreading clamp 14. The spreading operation for the laundry article 10a and its transfer to the feed conveyor 12 then take place in the customary way.

The free corner 17 of the laundry article 10a can be introduced manually into the associated spreading clamp 15 directly. Alternatively, a mechanical transfer, as illustrated in Figures 1 and 2, is provided. Accordingly, the corner 17 is introduced into a separate transfer clamp 30 (by hand) and transferred from this to the spreading clamp 15. As shown in Figure 1, the transfer clamp 30 can be moved towards the spreading clamp 15 and back into a receiving position on a travelling rail 32 by means of a bogey 31. The transfer of the laundry article 10a or the corner 17 to the spreading clamp 15 provided in the extension of the path of movement of the transfer clamp 30 takes place automatically. For this purpose, the transfer clamp 30 is made U-shaped, so that a region of the corner 17 extending between legs can be conveyed into the spreading clamp 15.

Figure 2 shows an alternative version in respect of the drive of the transfer clamp 30. Here, this is attached to a pivoting arm 33 which is movable towards

the spreading clamp 15 and back into the receiving position by means of a crank mechanism 34.

5 The corner 16 of the laundry articles 10 which is held by the transport clamp 20 can likewise be extracted from the transport clamp 20 and transferred to the associated spreading clamp 14 automatically by mechanical means. This operation can replace the manual extraction of the corner 16 from the transport clamp 20 in the exemplary embodiments described above.

10 For this purpose, the transport clamps 20 are arranged on the article conveyor 18 or on the discharge conveyor 28, in such a way that in the region of the feed station 19, in this particular case in the region of the lower deflecting roller 26, they arrive in succession at the transfer member 35. This is mounted adjacent to the discharge conveyor 28 at a fixed location, but pivotably about a pivot axis 36 pointing in the conveying direction of the laundry articles 10. The flat plate-shaped transfer member 35 can be pivoted out of a vertical 15 position for receiving a downward-pointing transport clamp 20, together with this, into a horizontal position 20 (the position in Figures 3 and 4).

When the transport clamp 20, together with the laundry article 10a, is in horizontal alignment, the 25 (mechanical automatic) transfer to the adjacent spreading clamp 14 can take place. For this purpose, in the embodiment according to Figure 3, the transfer member 35 is moved in the direction of the spreading clamp. To this effect, the transfer member 35 is movable by means 30 of track rollers 37 on a supporting rail 38 extending in a conveying direction. The transport clamp 20 is moved by the transfer member 35, together with the laundry article 10a, into the region of the spreading clamp 14, so that the latter can grasp the laundry article automatically. This terminates the operation of transferring 35 the laundry article 10a to the entry machine 11. During the reception of the laundry article 10a by the spreading clamp 14, the transport clamp 20 is subjected to stress with an opening effect, for example by cams of fixed

location which act on movable members of the transport clamp 20. This then returns to the initial position together with the transfer member 35.

5 The automatic transfer of the laundry article to the spreading clamp 14 is possible because of an appropriate design of the transfer member 35. Next to the transport clamp 20 resting on it, the transfer member 35 forms a trough-shaped depression 39 which is laterally open in the conveying direction. The depression 39 is
10 covered by a corner region of the laundry article 10a. During the transfer of the laundry article 10a, the spreading clamp 14 enters the region of the depression 39, with the result that an (upper) edge of the laundry article 10a is introduced into the spreading clamp.

15 Figure 4 shows an alternative to the foregoing version insofar as, here, the spreading clamp 14 of the entry machine 11 is arranged so as to be displaceable in the conveying direction of the laundry article. As illustrated, the spreading clamp 14 can be moved on supporting rods 40 in the direction of the feed station 19 or in the direction of the transfer member 35 provided at a fixed location, for example by means of a pressure-medium cylinder (not shown). The spreading clamp 14 is thereby moved into the region of the depression 39 of the
20 transfer member 35, so that the laundry article is received by the spreading clamp 14 in the way already described. The latter then returns to the initial position. The spreading operation for the laundry article 10a can now begin.

25

30 The above-described substantial mechanisation of the transfer of laundry articles 10a to an entry machine 11 can be achieved especially effectively on an installation with a dual mode of operation, as illustrated in Figures 5 and 6. Large laundry articles (bed covers, bed sheets, table linen, etc.) are extracted from a storage container 41 by two attendants 42, 43 and transferred respectively to two parallel article conveyors 18, 18a. The two independent parallel article conveyors 18, 18a lead to a common entry machine 11 of appropriate (double)

35

width with a feed conveyor 12 of appropriate size. The entry machine 11 is equipped with two independently working spreading devices 13, 13a arranged next to one another. Each of these spreading devices 13, 13a is
5 designed in the way described, in particular each with at least two spreading clamps 14, 15 movable relative to one another. The two article conveyors 18, 18a terminate respectively in front of the associated spreading devices 13, 13a, specifically offset relative to the mid-plane of
10 these in the way described. An attendant 29 is active between the two article conveyors 18, 18a in the region of the common feed station and tends both article conveyors 18, 18a and consequently both spreading devices 13, 13a. This is possible especially when, as described
15 and illustrated, the transfer of those corners 16 of the laundry articles 10, 10a held by the transport clamps 20 to a spreading device 13, 13a takes place automatically by mechanical means (Figures 3 and 4). In this version,
20 the attendant 29 merely has to handle one free corner 17 of each laundry article 10, 10a and introduce it into a clamp.

An exemplary embodiment with maximum mechanisation or automation of the handling of laundry articles is shown diagrammatically in Figure 7. The laundry articles
25 10 conveyed or stored by an article conveyor 18 in the version described are grasped mechanically, in the region of the storage conveyor 27, at a second downward-hanging corner 17 of the laundry article and, held at two corners 16, 17, fed to the spreading clamps 14, 15. For this
30 purpose, the transport clamps 20 are successively separated in the separating station 44 in the region of the storage conveyor 27, that is to say set apart from adjacent transport clamps 20. An edge-catching device 45 now takes effect in this separating station 44. This
35 consists essentially of a retaining rod 46 which is vertical in the initial position and which is pivotable about an upper pivot bearing 47. A catching clamp 49 is movable along or on the retaining rod 46 by means of a bogey 48, that is to say is movable in the vertical

direction. The transport clamp 20, together with the laundry article, is moved into a position adjacent to the edge-catching device 45. The catching clamp 49 is now moved out of an upper position (represented by broken lines in Figure 7) downwards along the retaining rod 46, the catching clamp 49 travelling along a vertical laundry-article edge and engaging round this. When the catching clamp 49 has arrived at the lower end of the vertical retaining rod 46, it is located in the region of the downward-pointing corner 17 of the laundry article. This is now grasped by the catching clamp 49.

The laundry article held at a further corner 17 is now transferred to an article conveyor, in particular to an auxiliary conveyor 50. This is equipped with transport clamps 51 which can correspond to the transport clamps 20. The corner 17 of the laundry article is introduced by means of the catching clamp 49 into a transport clamp 51 of the auxiliary conveyor 50. This consists, in the region of reception of the corner 17, of a horizontal storage conveyor 52 with a following discharge conveyor 53. The latter is of the same design as the discharge conveyor 28.

The auxiliary conveyor 50 is arranged at a distance from the article conveyor 18 and extends parallel to this. The distance is selected so that the laundry articles are conveyed into the region of the associated spreading clamp 15 by the transport clamps 51 or by the discharge conveyor 53.

The transfer of the two corners of a laundry article which are held by transport clamps 20, 51 of the article conveyor 18 or of the auxiliary conveyor 50 to the spreading clamps 14, 15 takes place automatically here, specifically in the way described according to Figures 3 or 4. In the exemplary embodiment of Figure 7, an arrangement similar to that of Figure 4 is selected. The transport clamps 20, 51 resting on pivotable plate-shaped transfer members 35, 54 and pivoted into a horizontal position provide the laundry article for reception by the spreading clamps 14, 15. These can be moved out

of the spreading device 13 transversely relative to the plane of the laundry article in the way described, until the laundry article 10a is received.

Figures 8 and 9 show the use of the apparatus according to Figure 7 on a dual installation. This is predominantly constructed in the same way as illustrated and described according to Figures 5 and 6. An auxiliary conveyor 50, 50a is assigned to each article conveyor 18, 18a, each with a device for grasping a downward-hanging corner 17 of a laundry article (edge-catching device 45). It is thereby possible for the laundry articles fed along two article conveyors 18, 18a to be transferred to two spreading devices 13, 13a completely automatically. Attendants 42, 43 are required merely to load the article conveyors 18, 18a.

Claims:

1. Method for feeding laundry articles to a mangle or the like, in which the laundry articles are moved in front of a feed conveyor leading to the mangle by a spreading device having at least two clamps (spreading clamps) for grasping two corners of the laundry article, the laundry articles being fed to a transfer station assigned to the spreading device by an article conveyor having a plurality of transport clamps for grasping one corner of the laundry article, characterized in that first a free corner of the laundry article is introduced into a spreading clamp (15) of the spreading device (13, 13a) and then the corner (16) held by the transport clamp (20) of the article conveyor (18, 18a) is removed from the article conveyor (18, 18a) and introduced into the other spreading clamp (14).

2. Method according to Claim 1, characterized in that the transfer of the (free) corner (17) of the laundry article (10) to the spreading clamp (15) takes place mechanically (by means of a transfer clamp 30), the corner (17) being introduced into the transfer member by hand.

3. Method according to Claim 1 or 2, characterized by a dual mode of operation, one attendant (29) being assigned to two article conveyors (18, 18a) and to two

spreading devices (13, 13a).

4. Method for feeding laundry articles to a mangle or the like, in which the laundry articles are moved in front of a feed conveyor leading to the mangle by a spreading device having at least two clamps (spreading clamps) for grasping two corners of the laundry article, the laundry articles being fed to a transfer station assigned to the spreading device by an article conveyor having a plurality of transport clamps for grasping one corner of the laundry article, characterized in that a free corner (17) of the laundry article (10) is grasped automatically by a conveying member, especially by an edge-catching device (45), and is transferred to a separate conveyor (auxiliary conveyor 50, 50a) and can be fed by this to the spreading device (13, 13a).

5. Apparatus for feeding laundry articles to a mangle or the like, in which the laundry articles are brought in front of a feed conveyor leading to the mangle by at least one spreading device with spreading clamps for grasping two corners of the laundry article, the laundry articles being feedable to a transfer station in the region of the spreading device by at least one article conveyor having a plurality of transport clamps for grasping one corner of the laundry article, characterized in that at least one of the spreading clamps (15) of the spreading device (13, 13a) is assigned an introduction member for a free corner of the laundry article (10) held by the article conveyor (18, 18a), for the (mechanical) transfer of the corner (17) to a spreading clamp (15).

6. Apparatus according to Claim 5, characterized in that the spreading clamp (15) for the free corner (17) of the laundry article (10, 10a) is assigned a transfer clamp (30) which is movable to and fro in the direction of entry of the laundry article.

7. Apparatus according to Claim 5 or 6, characterized in that at least one spreading clamp (14, 15) of the spreading device (13, 13a) is assigned a transfer member (35, 54) for transferring the corner (16, 17) from

a transport clamp (20, 51) directly to a spreading clamp (14, 15).

8. Apparatus according to Claim 7 and one or more of the further claims, characterized in that a corner region of the laundry article (10, 10a) is kept free and in horizontal alignment on the transfer member (35, 54), in such a way that this region can be introduced into the spreading clamp (14, 15) as a result of a relative movement in relation to the latter.

9. Apparatus according to Claim 8, characterized in that the plate-shaped transfer member (35, 54) has a groove-shaped depression (39) which is covered by the laundry article (10, 10a) and in the region of which the spreading clamp (14, 15) enters.

10. Apparatus according to Claim 7 and one or more of the further claims, characterized in that the transfer member (35, 54), taking up transport clamps (20, 51), shifts corner regions of the laundry article (10, 10a) into a position for reception by the spreading clamps (14, 15), especially out of a vertical transport position into an essentially horizontal transfer position.

11. Apparatus according to Claim 5 and one or more of the further claims, characterized in that at least one of the spreading clamps (14, 15) is movable to and fro in the conveying direction of the laundry articles (10, 10a), especially if movable out of the region of the spreading plane for the reception of a laundry article (10, 10a).

12. Apparatus according to Claim 7 and one or more of the further claims, characterized in that the transfer member (35, 54) is movable to and fro in the conveying direction of the laundry articles (10, 10a).

13. Apparatus according to Claim 5 and one or more of the further claims, characterized by several, especially two article conveyors (18, 18a) extending at a distance from one another and by two spreading devices (13, 13a) working independently of one another and arranged next to one another in front of a feed conveyor (12) of appropriate width, the article conveyors (18, 18a) each being

assigned to a spreading device (13, 13a).

14. Apparatus according to Claim 5 and one or more of the further claims, characterized in that a free corner (17) of a laundry article (10) held by a transport clamp (20) of an article conveyor (18, 18a) can be grasped by a clamp member and fed to a separate conveyor (auxiliary conveyor 50, 50a), and the laundry article (10) held at two corners (16, 17) can be fed to the spreading device (13, 13a).

15. Apparatus according to Claim 14, characterized in that the free corner (17) can be grasped by an edge-catching device (45) with a catching clamp (49) and, as a result of a pivoting movement of the latter, fed to the auxiliary conveyor (50, 50a).

16. Apparatus according to Claim 14, characterized in that the auxiliary conveyor (50, 50a) has individual, separately movable transport clamps (51) for grasping the corner (17) of the laundry article (10).

17. Method for feeding laundry articles to a mangle or the like substantially as described herein with reference to the drawings.

18. Apparatus for feeding laundry articles to a mangle or the like substantially as described herein with reference to the drawings.